THURSDAY, MARCH 25, 1880

THE INSTITUTION OF NAVAL ARCHITECTS

THE recent annual meeting of the Institution of Naval Architects was remarkable chiefly for the number of interesting papers affecting the mercantile marine. There were three of special interest, viz., "On Causes of Unseaworthiness in Merchant Steamers," by Mr. Benjamin Martell, Chief Surveyor to *Lloyd's Register;* "On Cellular Construction of Merchant Ships," by Mr. W. John, also of *Lloyd's Register;* and on "Steel in the Shipbuilding Yard," by Mr. W. Denny, of the well-known firm of W. Denny and Bros., Shipbuilders on the Clyde.

The subject of Mr. Martell's paper was, in view of the recent agitation in Parliament and elsewhere, deemed of such importance that the Council, contrary to the usual rule, devoted the whole of one day to its discussion. Certainly no better authority could be found to guide public opinion in forming a correct estimate as to the true causes of the numerous recent losses of grain-laden vessels, than the author of this paper. The public, led in this matter by the not too-well informed zeal of Mr. Plimsoll, has too hastily ascribed these losses to the prevalent custom of lading grain in bulk, without adequate provision having been made for preventing the shifting of the cargo to one side, or the other, of the vessel, in case heavy weather should be encountered. Without ignoring this cause of loss in ill-designed vessels, Mr. Martell takes a far wider view of the matter, and ascribes these numerous disasters to the following ten principal sources:—

"1. Weakness of structure from deficient scantlings, combined with faulty construction in arrangement and workmanship, together with inferiority of material.

"2. Deterioration, causing local defects and unseaworthiness.

"3. Absence of proper control over cocks, valves, and pipes connecting the engines and boilers with the sea. Also a want of proper arrangement of bilge pump suctions, and of suction pipes from sea and bilge, whereby water, from inadvertence or carelessness, can be run from the sea into a vessel.

"4 Faulty and deficient pumping arrangements, preventing the accumulated water being pumped from the wings in turn of bilge, after a vessel, from shifting cargo or other cause, has become inclined.

"5. Breaking down of machinery, and the consequent falling off of the vessel into the trough of the sea.

"6. Bad navigation—leading to collision or vessels running ashore.

"7. Inefficient protection of openings in the deck.

"8. Hasty and improper loading, particularly of grain cargoes in bulk, and deficiency of shifting boards or bulkheads, or other means to prevent cargo from shifting.

"9. Disproportionate dimensions of steamers, combined with undue height of double bottom, thereby causing, with some description of cargoes, deficiency of stability.

"10. Overloading."

Each of the foregoing causes has no doubt at some time or other claimed its victims, but as the first six are thoroughly well understood already, the paper deals chiefly with the fifth and the last four.

The breaking-down of machinery has probably been the cause of more disasters than is generally suspected. It is well known that the first-class Transatlantic steamers, provided with the most powerful engines, have often in very heavy weather as much as they can do to keep their course in safety. It will readily be seen that under-engined cargo steamers must under similar circumstances adapt themselves to a safe and practicable course, and can, when steaming full power ahead, only just manage to keep their positions, and may even in spite of all exertions drift astern. If in these cases the engines thus heavily strained become temporarily disabled, the vessel will refuse to answer her helm, and she will inevitably fall off into the trough of the sea, and be placed in the greatest danger. The same thing will happen, even if the engines work well, provided anything goes wrong with the stearing-gear, which is often of an intricate character.

The seventh source of danger, viz., inefficient protection of openings in the deck, should be, one would think, easy enough to provide against, by properly covering and inclosing all hatches, stokeholds, &c. But the inclosing of these spaces is discouraged by the operation of the Tonnage Laws. The following extract will throw light on this question:—

"The same may be said of the protection round the openings of the engine and boiler space. The best protection possible is an inclosed bridge house around the engine and boiler openings; but as the law at present stands, it encourages the ends of this bridge superstructure being left open instead of being closed by iron bulkheads.

"I was much struck with this a few months ago, when I officially visited a large number of steamers in course of construction in the North for the Atlantic trade, and on pointing out to the owners or builders the desirability of continuing the bridge house to the sides of the vessel, and inclosing it so as to secure effectively the casings round the engine and boiler openings against heavy Atlantic waves, I was invariably met by the observation that it would add too much to the working expenses of the ship, as this space would be measured for tonnage."

This clearly is a case for legislative improvement.

The eighth cause, viz., the improper loading of grain cargoes, is the one which, above all others, engrosses public attention at the present time. There is no doubt but that grain, when loaded too hastily in bulk, will settle very considerably, thus leaving empty spaces between the upper surface of the grain and the decks, rendering the cargo liable to shift in bad weather. In such cases, *if the vessel have but a small margin of stability*, she may only too probably capsize. Mr. Martell describes the method of loading and packing grain in various types of steamer, and the means which are adopted in order to prevent the cargo in the hold from settling and from shifting. The efficacy of these means depends largely upon the way in which they are carried out. It is commonly supposed that by carrying the grain wholly in bags, this source of loss would be obviated completely. Mr. Martell, however, tells us that a cargo composed partly of grain, and partly of bags, can be made just as safe as one containing nothing but bags; and that on the other hand the loading of all grain in bags will not cure the evil, if the vessel be deficient in stability, and if the other causes of danger be overlooked.

This question of deficient stability seems to us of the most vital importance, and we commend the following expression of opinion of Mr. Martell to the attention of Mr. Plimsoll and the Board of Trade:—

"In fact, the figures themselves in the Table of Losses show that there were as many coal-laden steamers as grain-laden steamers lost during the months of the past winter; and although it is possible for coal to shift similarly to grain, it is not a cargo which is prone to shift, or which would be considered dangerous in a fairly-designed vessel. In view of these facts there is nothing to show that the inherent deficiency of stability of the vessels, loaded as they were, might not have been as active an agent, if not a more active agent, in creating the disasters we deplore, as the shifting of the cargo."

It is pretty evident from the author's remarks that many of the steamers at present employed in the grain-carrying trade are ill-proportioned for this purpose; though their stability would be amply sufficient when carrying heavy non-homogeneous cargoes properly stowed. The remedy proposed for new vessels is greater beam and a higher freeboard, combined with a depth of double bottom just sufficient for the purposes of water ballast. For existing steamers of a dangerous type, the only remedy is judicious stowage. This may perhaps best be effected by lessening the weight of cargo between decks, and by bringing the vessel back to the load-line, by introducing a corresponding quantity of water ballast into the tanks in the hold. The only inconvenience of this course would be to sacrifice a small fraction of paying freight; a trifling consideration when compared to the greater security to human life.

The problem of designing these vessels so as to suit the peculiarities of all kinds of cargoes is by no means easy. The requirements of a vessel which has only to carry heavy dead-weights stowed low, and one which carries a homogeneous cargo, like grain or coal, with a high centre of gravity, are very different; and when the same vessel has at different times to carry each description of loading it becomes necessary to effect a compromise between too much stability in the first, and too little in the second case. In such cases it is best to err on the side of too much stability, and to correct this quality when heavy dead-weight cargoes are carried by raising the weights as far as possible.

Mr. John's paper "On Cellular Construction of Merchant Ships" is interesting, as describing a recent return to the system of longitudinal construction, first introduced by Mr. Scott Russell over thirty years ago, and carried out by him in numerous iron vessels, notably the *Great Eastern* and the *Annette*. Mr. Scott Russell first invented this system in order to supply a great want in the iron vessels of that day, viz., deficient longitudinal strength. Since then, however, the longitudinal strength of merchant ships has been amply provided for by the introduction of solid keelsons, skin platings, and of iron decks. The present reaction in favour of a longitudinal system of construction is, as Mr. John is careful to inform us, due not to the necessity for providing additional strength, but to the opportunities which it gives of incorporating water ballast tanks into the structure of the bottom of the vessel. The details of this paper, which is one of great interest and importance to practical shipbuilders, are of too technical a character to be put before our readers.

There are few questions of more practical importance to both shipbuilders and owners at the present time, than the substitution of steel for iron in the construction of ships. The greater strength of the new material renders lightened scantlings possible, and the weight thus saved in a vessel's hull represents so much addition to its cargo-carrying capacity. Mr. Denny's paper "On Steel in the Shipbuilding Yard" is a most valuable record of his firm's experience in the use of steel, and it will be a subject for sincere congratulation to all those who are interested, that Mr. Denny has pronounced the new material to be absolutely trustworthy in every respect, far more so indeed than wrought iron. At present the most vexed question in connection with the use of steel is, what limits of tensional strength shall be allowed. If it be wished materially to reduce the scantlings of vessels it is clear that a material of much greater tensional strength than ordinary wrought iron must be made use of. On the other hand the milder and more trustworthy the steel the lower is its strength in this respect, while very strong steels are proverbially hard and brittle. The Admiralty and the two great classification societies, viz., Lloyd's and the Liverpool Underwriters' Registry, have each at present different limits of tenacity. The Admiralty require that the breaking strength shall be between 26 and 30 tons per square inch; Lloyd's between 27 and 31; while the Liverpool Underwriters fix the limits between 28 and 32 tons. The question as to which of these pairs of limits is the best, was mooted both by Mr. Denny and by Mr. West, the Chief Surveyor to the Liverpool Underwriters, who followed Mr. Denny with a paper on "Steel for Shipbuilding." Both speakers inclined to the higher limits; in fact Mr. West went so far as to propose a minimum limit of 30 tons, and to have no maximum limit. He considers that a maximum limit is unnecessary, because the temper-bending tests in common use amply demonstrate whether or no the steel possesses the requisite ductility.

On the other hand Dr. Siemens, under whose patents most of the steel used in shipbuilding is manufactured, spoke strongly during the discussion in favour of the milder and more ductile material. His grounds for doing so were that the extensibility and strength of each variety of the material were the same up to strains of 15 tons per square inch, and that this strain is a long way beyond anything which the material would have to bear in practice.

There were only two papers of any importance bearing on the subject of the Royal Navy. The first was by Mr. Barnaby, and was a description of the *Nelson* class of protected cruiser. There are two of this class in existence at the present time, viz. the *Nelson* and the *Northampton*. They were originally designed as improvemements on the *Bellerophon* and the *Iron Duke*, and viewed from this point they embody many novel features, constituting no doubt great improvements. The protecting armour in the newer vessels is much more partial than in the older ones, but where it is applied the average thickness is 7·28 inches, as against 5·28, representing nearly double the protecting power. Again, the coal-carrying capacity of the *Nelson* and her sister-ship is 1,200 tons, as against 645 tons for the *Bellerophon* and 460 tons for the *Iron Duke*. This is a most important improvement. In fact the two last-named vessels with their small coal-carrying capacity hardly deserve the name of cruisers at all. The armament

of the new ships both in total weight as well as in weight of projectiles fired from the broadside, and right ahead and astern, is much superior to the older two.

Mr. Scott Russell's paper dealt with the true principle of the resistance of armour to shot. Like everything that comes from his pen, it is written clearly and forcibly. It advances for the first time a rational explanation of the great resistance of steel-faced armour-plates as compared with the old-fashioned armour.

In addition to the above many other papers were read, some of them being of great interest and originality. For instance, Mr. MacFarlane Grey's paper "On the Simplification of the Thermodynamics of Steam," which however much we may object to the word *simplification* in the title, is nevertheless a singularly bold and original attempt to account for many of the phenomena of steam and other effects of heat when applied to matter. Want of space however prevents our reviewing this paper in the way it deserves. The same remark applies to Mr. Merrifield's description of Prof. Amsler Laffon's new instrument for calculating simultaneously the area, the statical moment, and the moment of inertia of any closed figure.

Upon the whole the Institution of Naval Architects must be congratulated upon the very valuable and interesting nature of its transactions. It is only to be regretted, that on account of the large number of papers and the limited time for the meetings, so little time is often left over for discussion.

THE LOCAL ENDOWMENT OF RESEARCH

BIRMINGHAM enterprise and Birmingham manufactures are known all the world over. One of the present remarkable features of this hard-working provincial town is a gradual infusion of the apparatus of scientific culture, not before its time. Thus we have now a potential, college, to say nothing of an increase in the number of its educational institutions and scientific societies. One of the most recently founded of these institutions is the Birmingham Philosophical Society—a title which one is apt to associate with respectable dulness—a circulating library, and a well-stocked reading-room. But the Birmingham institution, founded only in 1876, is something very different, and bids fair to rival her well-known Manchester sister. Already has the Society published a third thick part of its *Proceedings*, containing a number of original papers that would do credit to a London society.

But Birmingham is nothing if not innovating; her politicians founded a new school of politics, and now her men of science have initiated a new departure in the conduct of scientific societies. This will be plain from the following circular, a copy of which has been sent us :—

"The Council, having taken into consideration the advisability of establishing an Endowment of Research Fund, will submit the following scheme for the consideration of the Society :—

"*Scheme for Establishing and Administering a Fund for the Endowment of Research in Birmingham*

"The Council are of opinion that this Society would be omitting a principal means of the advancement of science —the end for which all such associations exist—if it neglected the question of the endowment of research. To maintain a successful investigator in his labours, even though no results of immediate or obvious utility can be shown to spring out of them, is of interest to the community at large. Indeed it is just because the practical usefulness of such work is not immediate or obvious that it becomes necessary to give special support; for, otherwise, it would have its own market value, and endowment would be superfluous. But the proper and effectual administration of an endowment fund is perceived to be so beset with difficulty as often to deter even those who recognise the principle, from advocating it in practice. Most of the dangers usually foreseen would, however, as a rule, be avoided, simply by the distribution of such funds from local centres, under such a scheme as is now proposed.

"The Council are therefore anxious to establish a fund, in connection at once with the Society and the town, for the direct endowment of scientific research. And they are further of opinion that the eminent merits of Dr. George Gore, F.R.S., as an investigator of exceptional originality and success in the domain of chemistry and physics, clearly point him out as fittest to be the first recipient of endowment from the fund. In accordance with these views the Council propose the following regulations for the fund :—

"1. That the fund be entitled, 'The Birmingham Endowment of Research Fund.' 2. That contributions be invited, payable either at once, or in instalments distributed over a term of years, as individual subscribers may desire. 3. That the money collected be deposited with the Birmingham Banking Company, in the name of the Council of the Birmingham Philosophical Society; and that all cheques on this fund be signed by the president, the treasurer, and one of the secretaries for the time being. 4. That the management of the fund shall be in the hands of the Council of the Birmingham Philosophical Society, who shall have the power of allotting such sums and under such conditions as they may deem fit to any one or more persons engaged in scientific research, for the purpose of assisting them in carrying on their investigations. 5. The Council shall present a report of their proceedings in connection with the fund at the annual meetings of the Society.

"Subject to the approval by the Society of these General Regulations, the Council have resolved—1. That Dr. George Gore, F.R.S., be elected as the first recipient of an endowment from the fund. 2. That in order that Dr. Gore may have greater facilities for continuing in Birmingham his original researches, if the sum collected permit, the amount of 150*l.* per annum for three years be allotted to him. 3. That the first cheque on the sum subscribed be payable on the 1st of July of the current year."

These resolutions were carried unanimously at a full meeting of the Society on the 11th inst. It is not necessary for us to say a word in praise of the important initiative which has thus been taken by one of the youngest of our provincial societies. The lessons to be derived from this action seem plain. Nothing, we think, could conduce more to the encouragement of scientific research in this country than the establishment in the great centres of wealth or industry of funds similar to that with which the Birmingham Philosophical Society have resolved to endow Dr. Gore. To so enormously wealthy a town as Birmingham what is 150*l.* or even 1,500*l.* a year? And need we remind practical Birmingham manufacturers that in their own special lines the most lucrative results have been obtained from investigations that originally had no practical ends in view? Need we also remind them of what during the past few years their balance-sheets have given evidence over and over again,